PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference ...	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/IN2004/000070	International filing date *(day/month/year)* 26.03.2004	Priority date *(day/month/year)* 28.03.2003
International Patent Classification (IPC) or national classification and IPC B21B37/00		
Applicant THE TATE IRON AND STEEL COMPANY LIMITED		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 3 sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the opinion
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☒ Box No. VII Certain defects in the international application
   - ☒ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
26.10.2004	17.05.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Rechler, W Telephone No. +49 89 2399-2354

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IN2004/000070

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages	
1-13	as published
Claims, Numbers	
1-12	as amended (together with any statement) under Art. 19 PCT
Drawings, Sheets	
1/6-6/6	as published

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IN2004/000070

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1 - 12
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1 - 12
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1 - 12
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. There is no particular relevant prior art document available. The one-part form of the independent claim 1 is therefor admissible in the present case, in particular with regard to the complex and sophisticated cooperation of the numerous features defining the invention.

   Document US-A-3 253 438, which can be considered to represent the most relevant state of the art, discloses an automatic strip gauge control, which is completely different from the property prediction system of the present invention, though they have some features in common (the references in parentheses applying to this document):

   - a unit (42, 40) for providing data,
   - field devices (31, 33, 34, 35, 36, 38, 37, 39) for measuring process parameters during hot rolling, and
   - a computer (24), which normally includes a programmable logic controller, means for conversion of the measured data, a computation module for processing the data, a storing unit and a display unit.

2. The problem to be solved by the present invention was to provide an online system for property prediction of hot rolled coil over the complete length thereof.

   This problem is solved by the combination of features set out in the independent claim 1, especially by the combination of the apparatus features, which are known per se, with the particular data processed.

3. The present invention shall be considered to be new because no cited prior art document discloses all features of independent claim 1 in combination.

4. The cited documents do not disclose the essential subject-matter concerning the particular data processed. The available prior art cannot provide the skilled person with any lead to provide these particular data to a computing system and to combine all features defining the invention according to independent claim 1.

5. The invention shall be considered as susceptible of industrial application because it can be made or used in the metal processing industry.

6. Claims 2 - 12 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

Re Item VIII
Certain observations on the international application

Claims to a system are regarded as claims to an apparatus and not as claims to a method or process. Most of the features in the apparatus claim 1, however, relate to a method of using the apparatus rather than clearly defining the apparatus in terms of its technical features. The intended limitations are therefore not clear from this claim, contrary to the requirements of Article 6 PCT.

Thus, in order to meet the requirements of Article 6 PCT with respect to clarity, the system claimed in claim 1 should have been drafted as a method claim.

Re Item VII
Certain defects in the international application

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the background art disclosed in the documents US-A-3 253 438 and DE-A-199 41 600 is not mentioned in the description, nor are these documents identified therein.

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WE CLAIM :

1. A system for on-line display of property prediction for hot rolled coils in a hot strip mill comprising:
   - a unit (5) for providing data on rolling schedule with chemistry from the steel making stage;
   - field devices (FD1...FDn) for measuring process parameters during hot rolling;
   - a programmable logic controller (1) for acquiring data of measured parameters from said field devices (FD1...FDn) and feeding said data parameters to a processor (2);
   - means (3) for conversion of the measured data from time domain to space domain using segment tracking; and
   - a computation module (4) for processing said converted space domain data for predicting mechanical properties along the length and through the thickness of the strip being rolled;
   - wherein, said predicted data on mechanical properties outputted from said computation module (4) being stored in a unit (7) for use by said scheduling unit (5) at production planning and scheduling level.

2. The system as claimed in claim 1, wherein said field devices (FD1...FDn) comprise a pyrometer, a speedometer, a thickness gauge, a solenoid valve etc. for measuring data on process parameters.

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3. The system as claimed in claim 1, wherein said programmable logic controller (1) is a Westinghouse PLC 26 connected to said field devices (FD1...FDn) through coaxial cable using remote I/O.

4. The system as claimed in claim 2, wherein said programmable logic controller (1) is configured to capture data from said field devices (FD1...FDn) over 0.01 sec. using WESTNET I data highway with Daisy Chain Network topology.

5. The system as claimed in the preceding claims, wherein said processor (2) is an ALSTOM VXI 186 processor and the data transfer between said processor (2) and said programmable logic controller (1) is through WESTNET II using coaxial cable with Token Pass Network topology.

6. The system as claimed in the preceding claims, wherein said computation module (4) is provided with a deformation sub-module (41) for determining final austenite grain size after finish rolling.

7. The system as claimed in claim 1, wherein said computation module (4) further comprises a thermal sub-module (42) for determining the temperature drop during radiation while cooling said hot rolled strip.

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8. The system as claimed in claim 1, wherein said computation module (4) further comprises a microstructural sub-module (43) for determining the microstructural changes during phase transformation.

9. The system as claimed in claim 1, wherein said computation module (4) further comprises a precipitation sub-module (44) for determining the amount of aluminium nitrogen in the solid solution and in the precipitates after cooling.

10. The system as claimed in claim 1, wherein said computation module (4) is further provided with a structural property correlation sub-module (45) for calculating the yield strength (YS), ultimate tensile strength (UTS) and percentage elongation (EL) based on the phases present.

11. The system as claimed in the preceding claims, wherein a display unit (6) is provided for displaying a cooling temperature, ferrite grain size, yield strength, ultimate tensile strength, percentage elongation and nitrogen in solid solution/precipitate.

12. The system as claimed in the preceding claims, wherein a data warehousing device (8) is provided for storing the data generated by said computation module (4).

PATENT COOPERATION TREATY

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

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Date of mailing *(day/month/year)*: 6 September 2004 (06.09.2004)

Applicant's or agent's file reference

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority Date *(day/month/year)*
PCT/IN 2004/000070	26 March 2004 (26.03.2004)	28 March 2003 (28.03.2003)

International Patent Classification (IPC) or both national classification and IPC
B21B 37/00, B21B 38/00

Applicant
THE TATA IRON AND STEEL COMPANY LIMITED RESEARCH AND DEVELOPMENT AND SCIENTIFIC SERVICES

1. This opinion contains indications relating to the following items:

- ☒ Cont. No. I — Basis of the opinion
- ☐ Cont. No. II — Priority
- ☒ Cont. No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Cont. No. IV — Lack of unity of invention
- ☒ Cont. No. V — Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Cont. No. VI — Certain documents cited
- ☐ Cont. No. VII — Certain defects in the international application
- ☐ Cont. No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/IN 2004/000070

Continuation No. I

Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed.

Continuation No. III:

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of the because the description, claims or drawings (particular elements indicated below) or said claims Nos. 14 are so unclear that no meaningful opinion could be formed (specify):

According to Article 6 taken in combination with Rules 6.2a, 6.3a and 6.3b PCT, the claims should be clear and concise, and defined in terms of technical features of the invention. This rules are not fulfilled in claim No.14, as the subject matter of claim 14 does not include any technical feature.;

no international search report has been established for said claims Nos. 14;

Continuation No. V

Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims **1-13**	**YES**
	Claims **----**	**NO**
Inventive step (IS)	Claims **3-6, 8-13**	**YES**
	Claims **1-2, 7**	**NO**
Industrial applicability (IA)	Claims **1-13**	**YES**
	Claims **----**	**NO**

2. Citations and explanations:

The following documents have been cited in the Search Report:

D1: US 3253438 A

D2: DE 19941600 A1

D3: US 3568637 A

Document D1 discloses a system for on-line prediction of hot rolled coils in a hot strip mill comprising a computer and field devices for measuring process parameters during hot rolling, according claim 1. The computer uses a processor, online measured process parameters coming from the field devices, as well as a milling schedule for online predicting of parameters of the strip to be rolled. A computer normally includes a logic controller, computation modules and a display unit. Document D2 discloses a system for on-line determining crystallographic conversions, structure conversions and chemical conversions at a determined temperature in a hot strip rolling mill. It discloses also the deriving of parameters for the on-line process control and regulation to optimize the milling process. For a man skilled in the art it's therefore obvious to combine these two documents. Both documents disclose field devices for measuring data on process parameters, according claim 2. Document D1 further discloses the determining of a temperature drop of the rolled strip, according claim 7.

Consequently the subject matter of claims 1, 2, 7 and 14 is in comparison to each of the documents D1 and D2 novel, but does not involve an inventive step compared to a combination of these two documents.

Document D3 only discloses a more general state of the art of predicting process parameters in a computer controlled rolling mill, and therefore it does not interfere with the present application.

The characteristic features of claims 3-6 and 8-13 are not disclosed in the state of the art. Therefore it can be considered that the subject matter of claims 3-6 and 8-13 is, compared to each one of the documents D1 to D3, novel and involves an inventive step.

Industrial applicability is given.